A preliminary study on the long-term interest of horses in ropes and Jolly Balls

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ABSTRACT

A preliminary study involving riding school horses and two non-edible items, a Jolly Ball™ and a rope, was carried out in order to explore the long-term interest (two weeks) of horses in these items. Twelve horses were observed in their stalls during three observation periods per observation day (10:00h – 11:00h; 11:00h – 12:00h; 18:00h – 19:00h), using the scan sampling method. Each object was presented to each horse for two weeks and observations were carried out on Saturday and Sunday after introduction (weekend 1), after one week (weekend 2) and after two weeks (weekend 3). Both items were hung up on the front wall of the stall. Items were presented to the horses in a rotation system, so that each horse was exposed to each condition (Ball, Rope, Control).

Item related behavior occurred to a limited extent, possibly caused by the presence of sufficient hay quantities. The available bedding material also influenced this behavior, as horses showed more item related behavior when bedding material was unclean. The fact that both items were hung up may also have played a role. Both objects were equally interesting but the ball maintained the horse's interest over a longer period. In the presence of the rope however, no item related behavior was seen at the end of the second week. There was no effect observed on general activities or on abnormal behavior. This might be caused by the presence of only oral types of abnormal behavior (licking and manipulating box fittings) and the fact that the objects did not address the underlying causes of this behavior.

When horses are appropriately reared, non-edible items are not useful as enrichment. The balls however seemed to maintain interest over a longer period. To explore long-term interest in non-edible items further, a more extensive study with a larger sample size and continuous behavior recording is recommended. The way of providing this type of items should also be taken into account.

Keywords: horse; enrichment; non-edible; behavior

INTRODUCTION

In an attempt to reduce boredom and prevent the development of different types of undesirable and stereotypical behavior in horses, different toys were developed. Some specific toys reduce certain types of stereotypical behavior (Henderson and Waran, 2001; Whisher et al., 2011), but these toys are associated with a feed reward. Indeed, offering feed addresses the underlying causes of certain abnormal behaviors and hence these toys are effective. Furthermore, horses prefer edible materials or feed-related items (Jørgensen et al., 2011). By contrast, horses are often provided with commercial non-edible toys aiming to enrich their environment. To determine the actual enriching effect of toys, the goals of enrichment must be taken into account. As described by Newberry (1995), environmental enrichment is a modification of a captive environment, leading to an improvement in the biological function of animals. In addition, environmental enrichment encourages exploratory behavior patterns and the expression of foraging. It is however questionable whether horses show interest in commercial non-edible items and whether a long-term effect is maintained. Indeed, habituation occurs in other animal species and rotation of items is necessary (Driessen et al., 2008). In pigs, for example, enrichment should stimulate foraging and exploratory behavior in order to be effective (Van de Weerd et al., 2003).

Scientific research about the effect of commercial non-edible toys on horses is, to our knowledge, lacking. The hypothesis of this study was that horses show interest in non-edible toys, but the level of interest might depend on management factors. Therefore, the aim of this preliminary experiment is to gain a first impression of the (long-term) interest of riding school horses in a commercial toy, while maintaining normal day-to-day management. A non-commercial item (rope) was also included in the experiment.

MATERIALS AND METHODS

Housing and management

The horses were housed at a riding school in Belgium. During the observations, normal day-to-day management was maintained. The horses received two high-energy meals a day, one in

59 the morning (at 7:00h) and one in the evening (at 21:00h); these moments are henceforth
60 referred to as a "feeding events". The horses were given hay twice a day: during the morning
61 (at 9:00h) and in the evening (at 21:00h). The given amount of hay was adjusted to the size of
62 the horse. Stalls were cleaned once a week and horses received approximately 20kg of fresh
63 wheat straw after cleaning. All observed horses were housed individually and had an
64 automatic or manual water supply and a feeding bucket. Horses were housed in stalls tailored
65 to suit their size and they had visual contact with other horses. The environmental parameters
66 recorded for each horse and each observation period are reported in Table 1.

67 ***Animals and items***

68 The group of horses (=12) to which the items were introduced, consisted of seven mares and
69 five geldings of varied breeds, aged 5 – 25 years and ranging in height from 140 to 180cm.
70 None of these horses was known to perform weaving or crib-biting. In December 2011 the
71 items were introduced. The group of horses was randomly divided into three subgroups and
72 each subgroup received one of the items, a Jolly Ball™ (Ball) or a rope (Rope), or no toy
73 (Control) at all, during two weeks. The rope had a length of 35 cm, a diameter of 3 cm and
74 several knots. A medium-sized Jolly Ball™ (Horsemen's pride Inc., 10008 State Route 43
75 Streetsboro, Ohio 44241) was used. The green ball had a diameter of 25.4 cm and an apple
76 odor. For practical reasons, both items were hung up with the lower end at the horse's eye
77 level and against the front wall of the stall to avoid soiling by manure and urine. After two
78 weeks, the items were removed and each subgroup was either presented with a different item
79 or received no toy at all. This rotation system was repeated so that each horse was exposed to
80 each condition (Bulens et al., 2013). After each treatment period, the horses remained
81 unobserved for a week.

82 ***Behavioral observations***

83 Observations took place from December 2011 until February 2012. Each horse received each
84 item for a period of two weeks (three weekends) and was also observed during a control

period without objects. During each period, horses were observed on Saturday and Sunday after introduction (weekend 1), after one week (weekend 2) and after two weeks (weekend 3). Observations took place in the morning (10:00h – 11:00h), at noon (11:00h – 12:00h) and in the evening (18:00h – 19:00h). During observations, the observer walked along the stalls and recorded the behavior, using the scan sampling method (Bulens et al., 2013). Each horse was observed every 4 minutes, which resulted in 15 scans per horse per observation period. A short period of adaptation to the observer's presence was respected in each scan before recording the horse's behavior. The behavioral categories used during observation were based on the ethogram by McAfee et al. (2002) and Cooper et al. (2005) (Table 2). Item related behavior was based on the ethogram by McDonnell and Poulin (2002) and on a few observations of the horses' behavior to the presence of the items before the start of the study.

The horses were observed during three weekends in the presence of the same item. On the third Sunday, the items were removed after the last observation. There was a week during which horses remained unobserved after each round. The total duration of this study was 9 weeks.

Statistical analysis

The data were analyzed using procedures available in SAS version 9.3. Mean percentages for every behavioral category were calculated for every horse and every observation period (one hour) (Cooper et al., 2000). Since the behavioral data did not meet the normal distributional assumptions, they were dichotomized using the median as a cut-off value. For further analysis, a logistic mixed model (Glimmix procedure) was used. Within this model, group (Ball, Rope or Control) was included as a fixed effect and the parameters from Table 1, the rotation system, sex and age were included as covariates. The model was reduced by stepwise removal of insignificant ($P > 0.05$) parameters. The horse's identity was used as a random factor. Statistical significance was accepted at $P < 0.05$ and data are presented as percentage of scans ± SEM.

RESULTS

Almost 17% of our observations recorded horses standing alert and horses were dozing during 11% of our observations. Hay related behavior was seen during almost 37% of the observations. Bedding related behavior was seen during 23% of the observations. Horses showed during 0.339% of the observations item related behavior. No significant difference in item related behavior was found between the rope and the ball ($F_{(1,411)} = 1.82$; $P < 0.05$). No differences were seen in general activities between control observations and observations where a commercial or non-commercial toy was present ($P > 0.05$). The frequency of abnormal behaviors, such as licking walls ($P > 0.05$) and licking ($P > 0.05$) did not differ between groups (Figure 1).

The frequency of item related behavior depended on environmental parameters. More item related behavior was seen when bedding material was dirty compared to when bedding material was fresh ($P = 0.0406$). The frequency of item related behavior was influenced by the presence of hay ($P = 0.0436$). Horses showed this behavior more when hay was absent than when hay was present ($P = 0.0126$). Age and gender did not influence item related behavior (Table 3).

In the presence of the ball, no statistical difference was found in item related behavior between the first weekend, the second weekend and the third weekend ($P > 0.05$). In presence of the rope, the frequency of item related behavior differed between weekends. This behavior did not occur during the third weekend ($P = 0.0117$; Figure 2).

DISCUSSION

In 60% of the scans, the observed horses exhibited behavior related to roughage. This suggest that the management at this riding school provided the horses with an acceptable quantity of roughage. Only in 0.339% of our observations, item related behavior was recorded. Other research into commercial toys has found that horses displayed behavior towards the items

during 1 to 5% of the observations (Whisher et al., 2011). Research into two non-commercial items showed that horses displayed item related behavior during on average 4% of the scans (Bulens et al., 2013). The particular choice of providing the items attached to the front wall of the stall could have influenced item related behavior. For example, researchers compared four toys providing a sweet and observed that horses interacted least with the hanging sweet (Whisher et al., 2011). The original aim of the Jolly Ball™ is to provide a toy for the horse that can be pushed around in the stall and therefore it should be provided loose on the ground. However, the latter method possibly implies contamination of the object, causing a lower level of interest. Indeed, in pigs a loss of interest is observed when enrichment becomes soiled with faeces (Blackshaw et al., 1997). Further research should therefore investigate differences in effects when objects or toys are provided differently.

The effect of a rope has been studied in previous research. In this research, the rope was also attached on the front wall of the box but a higher percentage of item related behavior was reported (Bulens et al., 2013). Item related behavior towards a rope might show the horse's attempt to supplement the absence of roughage with additional fiber sources (Cooper and Albentosa, 2005). The low frequency of item related behavior towards the rope in the present study might indicate that the horses were reared more appropriately and provided with larger quantities of roughage which satisfy their needs.

Different environmental factors might influence the interest of horses in the objects. When hay was present during the observations, the frequency of item related behavior was lower compared to that recorded in other observations. This was also seen in other research (Bulens et al., 2013). As horses in their natural habitat spend 50% to 70% of their time eating (Zeitler-Feicht, 2003), horses show foraging behavior when hay is present. When no hay is present, horses are stimulated to search for other roughage sources. Bedding material could provide an alternative source. Indeed, horses show bedding related behavior when their motivation to eat has not been satisfied (Ninomiya et al., 2007). In addition, horses can also show bedding related behavior because they seek diversity. In the present study horses were housed on straw, which is, according to Werhahn et al. (2010) the best choice as bedding material. Due

to the fact that straw as bedding material occupies the horse and also serves as chewing material, item related behavior was lower when clean straw was available than in the case when bedding material is dirty. In the latter case, the motivation for investigating bedding material is low. Since it has been suggested that oral activities signal the motivation to eat (Cooper and Albentosa, 2005), horses possibly redirect eating motivations or frustrations towards the items (Bulens et al., 2013). Due to the low interest in the items provided when housed on straw, it could be interesting to verify the effect of non-edible items in horses housed on other bedding materials.

Jørgensen et al. (2011) suggested a loss of interest towards enrichment items as the period during which the animals were exposed to the item was prolonged. In this study, behavior towards the Jolly Ball™ was still observed after two weeks. Individual differences seemed to be present. However, the motivation to display behavior towards the items is not very clear. In the presence of the rope, no item related behavior was observed during the third weekend, while this behavior was still demonstrated in the presence of the ball. Thus, the results suggest that balls maintain the horse's interest for a longer period. As previously mentioned, the frequency of item related behavior towards the rope seems to depend on the provision of sufficient roughage quantities.

The items in this study influenced neither general activities nor abnormal behavior. The type of abnormal behavior observed most frequently in this study was oral activity, such as licking and manipulating box fittings, which suggests the horses exhibit behavior driven by a motivation to eat (Cooper and Albentosa, 2005). The presented objects did not address the underlying causes of these oral activities and hence their presence was not reduced. However, in a previous study, manipulating box fittings tended to be lower in the presence of a rope (Bulens et al., 2013).

When interpreting these results, the observation method and the fact that the horses were housed on straw must be accounted for. Also, it should be noted that the observed horses did

not show any stereotypical behaviors such as weaving or wind-sucking and the frequency of other unwanted behaviors was low.

CONCLUSION

In this study most horses showed limited interest in the items, likely due to the sufficient hay quantity provided. When horses are appropriately reared, this kind of environmental enrichment is not useful. The balls however seemed to maintain interest over a longer period. To explore long-term interest in non-edible items further, a more extensive study with a larger sample size and continuous behavior recording is recommended. The way of proving these type of items should also be taken into account.

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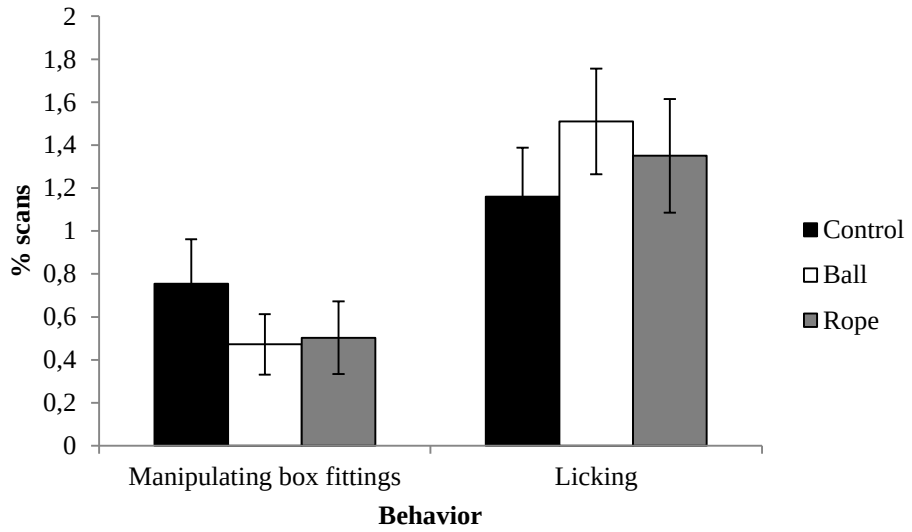
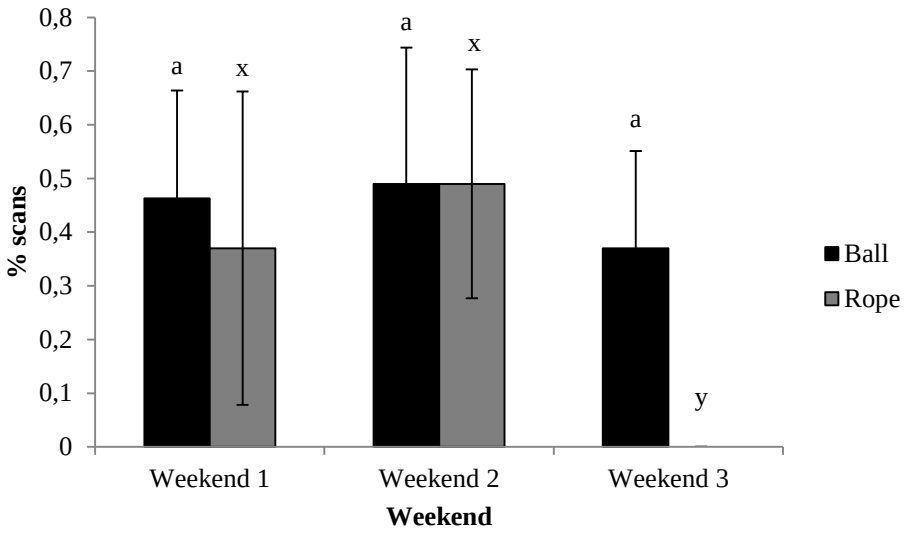


Figure 1 The observed frequency (Mean % ± S.E.M.) of oral abnormal behaviors during control observations and in presence of the objects (Ball, Rope).



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256 **Figure 2** Frequency of item related behavior (Mean % ± S.E.M.) in presence of balls and
257 ropes, after introduction (weekend 1), after 1 week (weekend 2) and after 2 weeks (weekend
258 3). Significant differences ($P < 0.05$) are indicated with different letters per item ("a-b" for
259 ball; "x-y" for the rope).

260 **Table 1** The different management factors and their levels.

Factor	**Levels**
Time of day	Morning, noon, evening
Quantity of bedding	None (there is no bedding material at all), limited (the quantity of bedding material does not cover the whole floor of the box), enough (the whole floor is covered with bedding material), fresh bedding material
Cleanness of bedding	Clean, not clean, fresh (fresh bedding material is given before or during the observation)
Quantity of hay	Present, absent, during (fresh hay is given during the observation)

Feeding event	Before, during or after the observation
Level of surrounding activities	Low (1), medium (2), high (3)

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Table 2 Description of the observed categories of behavior (McAfee et al., 2002; McDonnell and Poulin, 2002; Cooper et al., 2005).

Behavior	**Definition**
Stand alert	Stand with eyes open and ears pricked
Stand doze	Standing but not appearing to pay attention to surroundings. Typically eyes shut or half closed and the ears are not erected
Lying	Lying recumbent or sternal
Locomotion	Moving from one location in the box to another, not overtly repetitive ("Box-walking")
Drink	Drinking from the water supply
Eat	Eating concentrates or carrots
Hay	Eating or occupied with hay
Bedding	Sniffing, nosing or eating bedding material
Eliminate	Urinating or defecating
Vocalization	Vocalizing
Scrape	Scraping the floor
Kick	Kicking stall door or other fittings
Lick	Playing with the tongue or licking of the mouth
Nod	Repetitive vertical movement of the head
Self-grooming	The horse grooms itself
Licking box fittings	The horse licks on box fittings
Item related behavior	Sniffing, licking, biting, pushing or focusing on the item

Other activities	Any activity not covered by the above

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264 **Table 3** Factors of influence on the observed frequency of item related behavior (Mean % ±
265 S.E.M.).

	Mean	**S.E.M.**	**P value**
Freshness bedding material			0,0466
Clean	0,290[a]	0,105	
Not clean	0,667[a]	0,206	
Fresh	0,0533[b]	0,0533	
Presence of hay			0,0436
Present	0,110[a]	0,0545	
Absent	0,594[b]	0,163	
Hay given during the observation	0,494[ab]	0,342	
Bedding material			0,0397
Straw	0,308[a]	0,0748	
Flax straw	1,18[b]	0,855	
Gender			
Mare	0,295	0,0904	> 0,05
Gelding	0,398	0,138	
Age			
3 - 12 years	0,414	0,111	> 0,05
> 12 years	0,201	0,0887	

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267 [ab] Per parameter, means without a common superscript letter differ significantly ($P < 0.05$)